Magnetic shielding topology applied to low power Hall thrusters

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RÉSUMÉ

Hall thrusters are one of the most used rocket electric propulsion technology. They combine moderate specific impulse with high thrust to power ratio which makes them ideal for a wide range of practical commercial and scientific applications. One of their limitations is the erosion of the thruster walls which reduces their lifespan. The magnetic shielding topology is a proposed solution to prolong this lifespan.

In this research it is implemented on a small 200W Hall thruster. The low power magnetically shielded Hall thruster is compared with an identically sized unshielded one. The ion behavior inside the thruster is measured and significant differences are found across the discharge channel. Both thrusters are tested with classical BN-SiO2 and graphite walls. The magnetically shielded thruster is not sensitive to the material change while the discharge current increase by 25% in the unshielded one. The result is a maximum efficiency of 38% for boron nitride in the unshielded thruster but only 31% with graphite. The shielded thruster achieves a significantly lower efficiency with only 25% efficiency with both materials.